25X1A8a

[redacted]

SPERRY MK. 22

GYROCOMPASS EVALUATION

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1. INTRODUCTION. 25X1A8a

1.1. [redacted]

1.2. [redacted]

1.3. [redacted]

14 July 1961.

2. GENERAL DESCRIPTION OF MK. 22 GYROCOMPASS.

2.1. The Mk. 22, Mod 0, Gyrocompass is a compact (less than one (1) cubit foot), lightweight (24 pounds total) system which consists of the following major components:

2.1.1. Master Compass.

2.1.2. Amplifier Unit.

2.1.3. Power Supply (12 volt).

2.2. A general description of the above-mentioned components is provided below:

2.2.1. Master Compass.

a. The gyrocompass, or master compass, which is a direct reading compass is the principle unit in the system. Figure No. 1 shows the elements of the master compass.

b. The five basic parts of the master compass are listed under this heading, along with a description of the function of each part.

(1) The sensitive element, which contains the dual gyros, is the north seeking element of the compass and, together with its mounting, provides the gyro with the necessary three degrees of freedom. The gyros are suspended from a nearly frictionless wire support within the vertical ring and are free to turn through small angles in azimuth with respect to the phantom element.

(2) The phantom element supports the sensitive element and maintains azimuth alignment with it by means of a follow-up system. The compass card is fixed to the phantom element.

(3) The liquid ballistic is supported by the gyro cases in such a way that it exerts torque on the sensitive element. The torque causes the sensitive element to seek and settle on north. The liquid ballistic is also known as the controlling element.

(4) The spider element supports the phantom element and the other smaller components.

(5) The binnacle houses the foregoing components and supports the spider in gimbals.

2.2.2. Amplifier Unit.

a. The amplifier unit is in part a component of the gyro's follow-up system. The function of the follow-up system is to maintain the phantom element in alignment with the sensitive element of the gyrocompass.

b. The follow-up amplifier, which is a part of the amplifier unit, is employed to provide the required voltage and power amplification to the follow-up pick-off signal in order to align the azimuth position of the phantom element and vertical ring with the azimuth position of the gyrosphere. The amplifier also provides the required stabilization of the follow-up system.

c. The amplifier unit also contains the necessary power switching, indicators, and interconnections between the primary power source, AC generator, follow-up amplifier and the master compass.

2.2.3. Power Supply (12 Volt).

a. The power supply, which is an inverter, converts the available 12-volt DC supply to 115-volt, 3-phase, 400 cycle voltage used to operate the compass.

b. The inverter is of dynamotor construction, having a single armature core for both the DC and AC windings. The input functions as a 4-pole DC compound motor and the output as an alternator.

c. Low potential direct current is supplied to the field windings, causing the armature to rotate. As the armature rotates, conductors of the AC windings cut the magnetic flux produced by the DC field. This generates an AC potential which is fed to the load circuits through slip rings and brushes.

3. DESCRIPTION OF GYROCOMPASS INSTALLATION.

3.1. The 12-volt power supply, along with the system's amplifier unit, were mounted on the port bulkhead in the radio room as shown in Figure No. 3.

3.2. The master compass, which was secured to an aluminum angle base, was mounted on the main engine instrument panel as shown in Figure No. 2.

3.3. The power cable provided with the system, which was used to connect the power unit and the master compass, penetrated the top of the main engine instrument control panel and the radio room's port bulkhead.

4. OPERATIONAL FIELD TESTS AND RESULTS.

4.1. Phase I Test.

4.1.1. Description of Test.

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a. [redacted]

4.1.2. Results.

a. After corrections were made for wind and current, a 2^{o} error was recorded.

4.2. Phase II Test.

4.2.1. Description of Test.

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a. [redacted]

4.2.2. Results.

a. During the Annapolis to Norfolk run, a 15^{o} error was recorded, while, a 5^{o} error was observed during the return run.

b. Based on the magnitude of the above errors, 25X1A8a [redacted] thoroughly inspected the master unit for defects. The investigation revealed that the master unit's compass card was misaligned. Heat from the boat's cabin area, coupled with the heat generated internally by the unit's motor, caused the compass card to warp resulting in the above mentioned misalignment. Therefore, 25X1A8b [redacted] concludes that the gyrocompass is not adequately ventilated when the plexiglass binnacle cover dome is in the closed position.

4.3. Phase III Test.

4.3.1. Description of Test.

a. 25X1A8a [redacted] 25X1A8a [redacted]. In order to insure that the master compass was adequately ventilated, 25X1A8a [redacted] left the binnacle cover dome in the "open" position throughout this phase of the test.

4.3.2. Results.

a. The gyrocompass, which was turned on approximately fifteen (15) minutes prior to departure from Annapolis, failed to settle on a heading and tumbled erratically throughout the test. The tumbling action was primarily due to the pitching and rolling motion of the Jean B. As a result, [redacted] 25X1A8a was unable to utilize the gyrocompass due to its extremely poor performance.

b. Therefore, on 19 July 1967, the Sperry Mk. 22, Mod 0 gyrocompass and its associated components, were removed from the [redacted] 25X1A8b and were replaced by a magnetic compass.

5. CONCLUSIONS.

5.1. Based on the test results, the following conclusions are drawn:

a. The Sperry Mk. 22, Mod 0 Gyrocompass is completely unreliable.

b. The fact that the compass tumbled excessively due to the pitching and rolling motion of the [redacted] 25X1A8b indicates that the compass is not suited for installation on a 58' craft.

c. The plexiglass binnacle dome must remain open when the compass is operating in order to insure adequate ventilation to the master compass.

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d. [redacted] concludes that the accuracy of a properly compensated magnetic compass will exceed that of the Sperry Mk. 22.

6. RECOMMENDATIONS.

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6.1. [redacted]

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